

电力系统仿真及分析计算

基于隐式梯形-时步保持法的3/12相电机建模

纪锋, 付立军, 王公宝, 王刚

舰船综合电力技术国防科技重点实验室(海军工程大学)

摘要:

综合电力系统(integrated power system, IPS)包含3/12相双绕组发电机等特殊高阶非线性元件, 现有电力系统电磁暂态仿真软件均不提供其仿真模型。为此, 采用隐式梯形法对双绕组发电机数学模型进行差分离散化处理, 通过定、转子分离迭代, 推导出电机等效电路模型, 并在PSCAD中建立双绕组发电机仿真模型。应用时步保持算法, 将模型的仿真时步划分为计算时步和保持时步, 提高了计算速度。最后, 构建综合电力推进系统试验平台, 发电机空载短路、推进系统调速的试验与仿真结果吻合, 验证了建模方法的有效性和所建模型的正确性。研究表明, 基于隐式梯形-时步保持算法的建模方法能够准确高效地建立双绕组发电机的仿真模型, 可应用于EMTP类仿真软件, 并可推广至IPS各类多相电机建模。

关键词: 综合电力系统 隐式梯形法 时步保持算法 双绕组发电机 仿真模型

Modeling of 3/12-phase Generator Using Implicit Trapezoidal & Time-step-holding Method

Ji Feng, Fu Lijun, Wang Gongbao, Wang Gang

National Key Laboratory for Vessel Integrated Power System Technology (Naval University of Engineering)

Abstract:

The integrated power system (IPS) contains special, high-order and non-linear components like 3/12-phase double winding generators. These components' simulation models are not offered by any power system electromagnetic transient simulation software. To model the double winding generators, the implicit trapezoidal method was applied to transfer the double winding generator's mathematical model into difference equations. By using the stator-rotor-separate iteration method, the generator's equivalent circuit model was derived. Then, the simulation model of double winding generators was built in PSCAD. During the modeling, the time-step-holding method was introduced to divide the model's simulation steps into computation steps and holding steps. In this way, the calculating speed was increased. Finally, the test bed of integrated electric propulsion system was constructed. The experiments on no-load short-circuit of the generator and on the speeding of the propulsion system were carried out and the same events were then simulated. The comparison between experimental and simulative results shows the availability of the modeling method and the correctness of the 3/12-phase double winding generator model. The study shows that the modeling method introduced in this paper can be used to build the simulation model of double winding generators accurately and efficiently. It can be applied to other EMTP-kind simulation software, and can be used for modeling of other multi-phase machines in IPS.

Keywords: integrated power system (IPS) implicit trapezoidal method time-step-holding method double winding generator simulation model

收稿日期 2011-01-14 修回日期 2011-04-09 网络版发布日期 2011-12-05

DOI:

基金项目:

国家自然科学基金项目(50977090, 51077130)。

通讯作者: 纪锋

作者简介:

作者Email: jifeng.ips@gmail.com

参考文献:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(441KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 综合电力系统
- ▶ 隐式梯形法
- ▶ 时步保持算法
- ▶ 双绕组发电机
- ▶ 仿真模型

本文作者相关文章

- ▶ 纪锋
- ▶ 付立军
- ▶ 王公宝
- ▶ 王刚

PubMed

- ▶ Article by Ji,f
- ▶ Article by Fu,L.J
- ▶ Article by Yu,G.B
- ▶ Article by Yu,g

本刊中的类似文章

1. 郑超 汤涌 马世英 盛灿辉 魏强 盛浩.基于等效仿真模型的VSC-HVDC 次同步振荡阻尼特性分析[J]. 中国电机工程学报, 2007,27(31): 33-39
2. 韩忠旭 高春雨 齐小红 李丹.对一种火电机组数学模型的剖析[J]. 中国电机工程学报, 2006,26(24): 125-130
3. 邓占锋 王轩 周飞 雷晰 于坤山 邱宇峰.超高压磁控式并联电抗器仿真建模方法[J]. 中国电机工程学报, 2008,28(36): 108-113
4. 章程 方志 胡建杭 赵龙章 邱毓昌.不同条件下介质阻挡放电的仿真与实验研究[J]. 中国电机工程学报, 2008,28(34): 33-39
5. 韩忠旭 齐小红 刘敏.单元机组的实用非线性数学模型及其应用[J]. 中国电机工程学报, 2006,26(1): 58-65
6. 王洪江 孙保民 田进步.一种非线性系统鲁棒故障检测的方法[J]. 中国电机工程学报, 2007,27(5): 81-86
7. 陈来军 陈颖 梅生伟 许寅 付立军 纪锋.一种混合并行算法及其在多相交直流混合电力系统中的应用[J]. 中国电机工程学报, 2010,30(28): 39-45
8. 黄靖 张晓锋 叶志浩.基于多智能体的船舶综合电力系统故障恢复方法[J]. 中国电机工程学报, 2011,31(13): 71-78
9. 何正友 胡海涛 方雷 张民 高仕斌.高速铁路牵引供电系统谐波及其传输特性研究[J]. 中国电机工程学报, 2011,31(16): 55-62